

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
14 February 2002 (14.02.2002)

PCT

(10) International Publication Number  
**WO 02/013343 A3**

(51) International Patent Classification<sup>7</sup>: **H01S 5/12,**  
5/40, 5/026

(21) International Application Number: PCT/US01/24969

(22) International Filing Date: 9 August 2001 (09.08.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
60/224,384 9 August 2000 (09.08.2000) US  
60/244,696 30 October 2000 (30.10.2000) US

(71) Applicant (for all designated States except US): **JDS UNIPHASE CORPORATION** [US/US]; 80 Rose Orchard Way, San Jose, CA 95134 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **MISSEY, Mark** [US/US]; 1518 Vista Club Circle, Apartment 302, Santa Clara, CA 95054 (US). **PEZESHKI, Bardia** [US/US]; 2404 Roosevelt Avenue, Redwood City, CA 94061 (US). **LANG, Robert, J.** [US/US]; 7580 Olive Drive, Pleasanton, CA 94588 (US).

(74) Agent: **KLEMBCZYK, Jeff**; c/o JDS Uniphase Corporation, 3000 Merivale Road, Ottawa, Ontario K2G 6N7 (CA).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

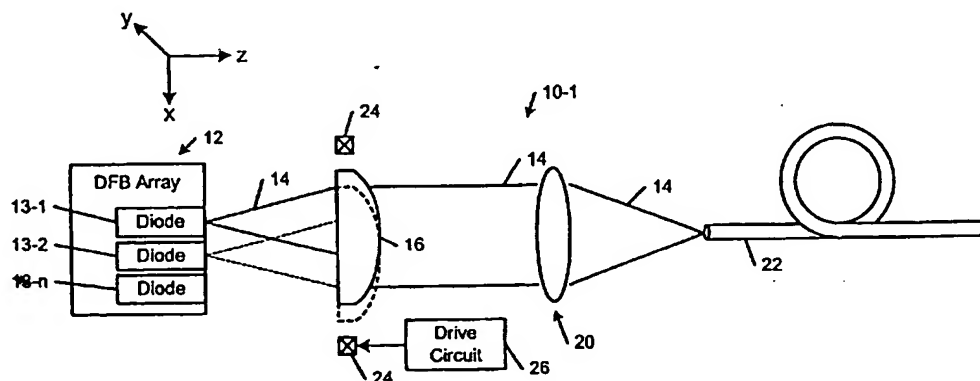
Published:

— with international search report

(88) Date of publication of the international search report:  
31 July 2003

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: **TUNABLE DISTRIBUTED FEEDBACK LASER**



(57) Abstract: A wavelength tunable laser includes a distributed feedback (DFB) array with first and second DFB laser diodes that generates first and second beams of light in first and second wavelength ranges. A microelectromechanical (MEMS) optical element selectively couples one of the first and second beams of light from the DFB laser array into an optical waveguide. The MEMS optical element includes a collimating lens and a thermal or electrostatic MEMS actuator for moving the collimating lens to select the one of the first and second beams of light. A focusing lens is located between the collimating lens and the optical waveguide. Alternately, the MEMS optical element includes a fixed collimating lens that collimates the first and second beams of light, a mirror, and a MEMS actuator for tilting the mirror to select the one of the first and second beams of light.

## INTERNATIONAL SEARCH REPORT

Intern. application No  
PCT/US 01/24969

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H01S5/12 H01S5/40 H01S5/026

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H01S G02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, INSPEC

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 784 183 A (TANIWATARI TSUYOSHI ET AL) 21 July 1998 (1998-07-21)  column 8, line 7-20; figures 7,9 column 9, line 12-41; claim 1  ---	1,27,52, 67,81, 88,95, 98,101, 102
A	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 02, 29 February 2000 (2000-02-29) & JP 11 326707 A (MATSUSHITA ELECTRIC IND CO LTD), 26 November 1999 (1999-11-26) abstract  ---  -/--	1,27,52, 67,95, 101

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

## \* Special categories of cited documents:

\*A\* document defining the general state of the art which is not considered to be of particular relevance

\*E\* earlier document but published on or after the international filing date

\*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

\*O\* document referring to an oral disclosure, use, exhibition or other means

\*P\* document published prior to the international filing date but later than the priority date claimed

\*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

\*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

\*Z\* document member of the same patent family

Date of the actual completion of the international search

21 January 2003

Date of mailing of the international search report

28/01/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Claessen, L

## INTERNATIONAL SEARCH REPORT

Inter Application No  
PCT/US 01/24969

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 95 13638 A (GERMANN ROLAND ;HAUSSER STEFAN (CH); VETTIGER PETER (CH); IBM (US)) 18 May 1995 (1995-05-18) page 8; figure 5A ----	1,27,81, 88,98, 102
A	EP 0 924 821 A (NIPPON ELECTRIC CO) 23 June 1999 (1999-06-23)  figure 1 ----	1,27,52, 67,95, 101
A	US 5 289 485 A (MOORADIAN ARAM) 22 February 1994 (1994-02-22)  figure 1 ----	1,27,52, 67,95, 101
A	US 5 999 303 A (DRAKE JOSEPH D) 7 December 1999 (1999-12-07) cited in the application  the whole document ----	1,27,52, 67,81, 88,95, 98,101, 102
A	US 6 044 705 A (NEUKERMANS ARMAND P ET AL) 4 April 2000 (2000-04-04) cited in the application  the whole document ----	1,27,52, 67,81, 88,95, 98,101, 102
A	PATENT ABSTRACTS OF JAPAN vol. 005, no. 121 (E-068), 5 August 1981 (1981-08-05) & JP 56 060088 A (NEC CORP), 23 May 1981 (1981-05-23) abstract ----	1,27,52, 67,81, 88,95, 98,101, 102
P,X	PATENT ABSTRACTS OF JAPAN vol. 2002, no. 12, 12 December 2002 (2002-12-12) & JP 2002 246699 A (HITACHI LTD), 30 August 2002 (2002-08-30) abstract -----	1,27,81, 88,98, 102

## INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern I Application No

PCT/US 01/24969

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5784183	A	21-07-1998	JP 7226563 A US 5561682 A	22-08-1995 01-10-1996
JP 11326707	A	26-11-1999	NONE	
WO 9513638	A	18-05-1995	WO 9513638 A1	18-05-1995
EP 0924821	A	23-06-1999	JP 3119223 B2 JP 11186648 A EP 0924821 A1 US 6252897 B1	18-12-2000 09-07-1999 23-06-1999 26-06-2001
US 5289485	A	22-02-1994	US 5172390 A WO 9415386 A1 AU 2659592 A WO 9305553 A1	15-12-1992 07-07-1994 05-04-1993 18-03-1993
US 5999303	A	07-12-1999	US 6128122 A EP 0929894 A1 JP 2001525972 T WO 9809289 A1 US 6134207 A US 6301403 B1 US 6360035 B1 US 2002012491 A1	03-10-2000 21-07-1999 11-12-2001 05-03-1998 17-10-2000 09-10-2001 19-03-2002 31-01-2002
US 6044705	A	04-04-2000	US 5629790 A US 5648618 A US 5488862 A US 6426013 B1 US 6467345 B1 DE 69527714 D1 EP 0767915 A1 JP 9512904 T WO 9524652 A1	13-05-1997 15-07-1997 06-02-1996 30-07-2002 22-10-2002 12-09-2002 16-04-1997 22-12-1997 14-09-1995
JP 56060088	A	23-05-1981	JP 1472263 C JP 63020035 B	27-12-1988 26-04-1988
JP 2002246699	A	30-08-2002	NONE	